Adopting Mobile Internet?
Findings from a study on Mobile Internet services using a user centred perspective

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ABSTRACT

In this master thesis we investigate Mobile Internet with the help of a user perspective and discuss the problems of Mobile Internet today. As the Internet revolution evolves into the Mobile Internet revolution the need for usable and desirable wireless services is increasing. Designing web based services for mobile devices and mobile users is significantly different than designing web based services for desktop use. Not only are there differences in the underlying technology but also, and perhaps most important, in the way people use the services. Our main purpose in this thesis is to investigate the occurrence of Mobile Internet from a user's perspective, to present a definition of Mobile Internet and provide a deeper understanding of the phenomenon. The main objective is to present a theoretical framework regarding Mobile Internet usage and to investigate which user related factors to consider when developing services adapted for mobile use.

Keywords: Mobile Internet, mobile use, mobility, quality of use, utility, user experience, social factors, needs and desires.

PREFACE

This thesis is a result of a master's project conducted at the Department of Software Engineering and Computer Science at Blekinge Institute of Technology, Sweden. The master's project was produced in cooperation with a consultancy firm for digital media, Doberman AB. In this master's project we have gone through several stages of ups and downs throughout the study. Sometimes lost in deep discussions and sometimes filled with joy over sudden insights. We wish you a merry reading and a thrilled new insight in the world of Mobile Internet.

We would like to thank all the people who have helped us and contributed to our work. First of all we would like to pay our gratitude to our supervisors, Kari Rönkkö, from Blekinge Institute of Technology and Astrid Selling Sjöberg from Doberman AB for giving us splendid supervising and being very supportive and helpful during the work process. They have continuously contributed to our work with valuable insight, experience and ideas. Many thanks also to the people at Doberman for their support and encouragement. Furthermore, thanks to the respondents of our interviews and questionnaires, for supplying us with interesting thoughts on Mobile Internet. Finally, thanks go to Easyresearch and Fredrik Åberg for letting us use their web based tool to distribute and administrate our survey.

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1   INTRODUCTION

Our master's project has been done in cooperation with Doberman, a consulting firm for digital media, specialised in developing web and WAP based services. When we first came in contact with Doberman we did not really know what our focus on our master thesis would be. During our first time at Doberman we though discovered that much of their work was focused on Mobile Internet services, and mostly of this work was related to the WAP-portal Vodafone live!. Since Doberman is developing web based mobile services, the company has great interest in how Mobile Internet will evolve and be embraced by its future users. One way to get a better understanding of mobile use and how users will adopt Mobile Internet is to find out users' view of Mobile Internet services of today. Out of this came the idea of doing a study on Mobile Internet services using a user centred perspective and thereby getting users' apprehension and experience of today's Mobile Internet.

For the reader to fully benefit from the content of this thesis, basic knowledge of information technology and some knowledge in the interaction design field is preferable. We believe that this thesis will be of primary interest for those dealing with development of mobile services. We also hope that this thesis contributes to the part in computer science that is named interaction design (Gulliksen & Göransson 2002, p. 42), with special interest in mobile use and mobile users.

1.1   Background

Today's people are living in a more technical world than ever, a world that to a greater extent consists of surroundings and objects created by mankind. In this technical world the use of information technology is of significant importance. We are surrounded by information technology artefacts – designed objects containing information technology – in our work places, in meeting places and public places, but also in our homes and in our spare time. These artefacts in many ways shape our behaviour and our ways of everyday life.

While the world is becoming more technical the people that populate it become more mobile. Today's people travel more and longer distances than ever, peoples' work situations are more changeable than they used to be and we seem to be on our way at all times. People are on the move, both at work and otherwise. At most workplaces of today, people face situations in which they must be mobile in carrying out their ordinary tasks (Kristoffersen & Ljungberg 1999). This increased mobility among people in our information society increases the need of being able to access information independent of location (Dahlbom & Ljungberg 1999). One way of accessing necessary information when being mobile is to use Mobile Internet services.

When it comes to Mobile Internet, what is it really all about? There is no simple answer to that question because Mobile Internet can be seen as a number of different innovations. Also, one easily gets caught up in technical terms and buzzwords like WAP, GPRS, EDGE, UMTS and 3G. Are these technical terms the essence of Mobile Internet? We argue that, to the user, it is not. These terms all focus on technology and say little about how they will change our lives. For the majority of people (our discussion about different user groups is presented in chapter 5) that uses a product the technology is not interesting, they want solutions that simplify their lives, not technologies that complicate them (Norman 1998 p.

32). For example the ordinary user does not care whether EDGE gives a theoretical bandwidth of 384 kbit/s or if GPRS enables packet switching.

As the Internet revolution gradually will evolve into the Mobile Internet revolution the need for usable and desirable wireless services is increasing. Designing web based services for mobile devices and mobile users is significantly different than designing web based services for desktop use. Not only are there differences in the underlying technology but also, and perhaps most important, in the way people use the services (Welie & Ridder 2000). In order to offer real value to users, designers must focus on the quality of the wireless medium in its broadest terms, which means that both the detailed interaction design and the conceptual design of mobile services have to be optimally adapted to user needs. One way is to accomplish this by taking advantage of the natural qualities of the wireless medium and develop services that users needs and desires (Welie & Ridder 2000).

We have already seen the first steps of what can be called Mobile Internet with WAP. The shortcomings of WAP (time, cost, user interface etc.) have been obvious to the few users who actually tried it. There is clearly a lack of understanding of real user needs and how Mobile Internet can help users satisfy those needs. If mobile services do not deliver what people want, these services will fail no matter how brilliant the underlying technology is. Therefore, advances in network technology such as GPRS and UMTS will not automatically lead to better services (Ramsay & Nielsen 2000).

Naturally Mobile Internet will evolve and hopefully overcome the problems of WAP. But exactly into what, no one can really tell. Visions about the future vary, but a common denominator is that it will be everywhere, making our lives easier.

1.2   Interaction design

Many of the high-tech products of today that require users to interact with them to carry out their tasks (e.g., buying a ticket online from the web, photocopying an article, pre-recording a TV-program) have not necessarily been designed with the users in mind. Typically, they have been engineered as systems to perform set functions. While they may work effectively from an engineering perspective, it is often at the expense of how the system will be used by real people. The aim of interaction design is to redress this concern by bringing usability into the design process (Preece et al. 2002, p. 8).

In essence interaction design is defined as "designing interactive products to support people in their everyday and working lives". This entails creating user experiences that enhance and extend the way people work, communicate and interact (Preece et al. 2002, p. 6). A central concern of interaction design is to develop interactive products that are usable. Designing usable interactive products requires considering who is going to use them and where, when and why they are going to be used. Another key concern is to understand the kind of activities people are doing when interacting with the products. In our work we have been focusing at these issues when exploring the use of Mobile Internet services today and in our attempt to map out the future use of Mobile Internet.

1.3   Purpose & objectives

Our main purpose in this thesis is to investigate the occurrence of Mobile Internet from a user's perspective, to present a definition of Mobile Internet and provide a deeper understanding of the phenomenon. The main objective is to present a theoretical framework regarding Mobile Internet usage and to investigate which user related factors to consider when developing services adapted for mobile use.

1.4   Research questions

To present this theoretical framework regarding Mobile Internet usage we have to find out how users use, apprehend and experience Mobile Internet today. The theoretical framework is based on the following research questions.

- How do today's users use, apprehend and experience Mobile Internet?
- What are the main user related differences between Internet and Mobile Internet?
- When and why do people want to use Mobile Internet services?
- What adds value to end-users of Mobile Internet services?

1.5   Doberman & Vodafone

We have conducted our thesis work in cooperation with Doberman. Doberman is a consulting firm with 35 employees, specialising in branding companies using digital media, such as web and WAP. Doberman is a subsidiary company to Vodafone, a global phone operator. Doberman perform approximately 50 % of their total work for Vodafone, including parts of the development of the Vodafone WAP-portal Vodafone live!.

While performing our thesis work at Doberman we have also worked in close relation to an interaction designer at Doberman, our external supervisor. During this cooperation we have been involved in different projects, both relating developing mobile services and ordinary web based services. At Doberman we have amongst other things been involved in work correlating to the future versions of the WAP-portal Vodafone live! We have also conducted a number of technical translations for the Swedish market of mobile phone based products and services.

Since Doberman is unable to affect technical hardware and economical issues when developing mobile services, they focus on users and user experience. By working as interaction designers in the world of mobile development at Doberman, our thesis work have also been focusing on users and user experience, neglecting technical hardware and economical issues.

1.6   Research methodology

This master's project has been conducted as an explorative study (Dawson 2000, p. 11) and our research methodology is mainly based on literature studies and of our performed work at Doberman. The thesis related work performed at Doberman comprised of usability tests of the WAP-portal Vodafone live! and included interviews with users. To supplement our literature studies and our tests and interviews we have also performed a web based survey regarding Mobile Internet usage. The survey was mainly conducted to get users opinions and experience of today's Mobile Internet.

1.7 Delimitations

In this master's project we have delimited our work to the use of mobile services. We have not gone deeper into technologies for developing mobile services, such as WML, XHTML etc. or in the technologies that make Mobile Internet technically possible, e.g. GPRS, UMTS. In other words we do not have a technology focus. Economical and security aspects such as billing and trust are also important factors related to Mobile Internet usage, but these factors are not being further discussed in this thesis. We will neither go deeper into user interface design issues; designing user interfaces for small mobile devices are a challenging effort. Small displays on mobile devices and information appliances, such as mobile phones and personal digital assistants (PDA), provide special challenges for efficient user interface design, in particular web based services (Marcus 2001). These different aspects of designing user interfaces for mobile use will not be discussed further in this thesis.

In these days, the border between people's private and business role are getting blurred. It can be hard to make the distinction and sometimes the different roles have to be discussed in relation to each other. Our main interest in this thesis is however the use of Mobile Internet for private usage, not business. Since our work has been conducted in Sweden with Swedish respondents in our interviews and questionnaires, our thesis work is restricted to the Swedish market.

1.8 Disposition

In this thesis we have chosen not to use the traditional report disposition with distinct chapters for theory, empirical data and analysis. Of course, these elements can be found in the study but they are presented in a more integrated fashion. We believe that it will be easier for the reader to understand what is said and meant if we integrate theoretical and empirical findings with the related discussion in the same context.

The disposition of the thesis is as follows. In chapter 1 we have given a brief introduction to the area of interaction design and Mobile Internet and described our aim and objectives of this thesis. Chapter 2 gives a technological overview related to the area of Mobile Internet. Readers, who are already familiar with these technologies, do not necessarily have to read this chapter. Chapter 3 presents how we have conducted our research, which methods we have used and how we have used them. Chapter 4 presents the area of mobile use, which different types of mobility exists, what does mobile mean for a user? Chapter 5 presents a view of how to categorise users in different user groups. In chapter 6 we will bring the reader into the topic of quality of use, related to Mobile Internet usage. By quality of use we mean the different factors that make a user want to use a product or a service. In chapter 4, 5 and 6 theories are integrated with the results of our analysis. Based on an accumulated understanding of collected data a final analysis and discussion is presented in Chapter 7. In Chapter 7 there is also a conclusion which summarises the most important findings of our work and presents our recommendations of how to focus on user needs when developing mobile services. The finishing chapter is followed by a list of references.

There are numerous of acronyms in the high-tech industries, and we will not at all times explain all acronyms throughout the text. Instead the reader is provided with a glossary that can be found in appendix A. A major part of our master's project was conducted on behalf of Doberman, the results of this work is presented as separated reports and serve as appendices in this thesis. These appendices are the main outcomes of our empirical work. Appendix B is a summary containing the

results from our web based survey. The appendix presents the collected data and key findings derived from the questionnaires. Appendix C is a summary of our collected data from the interviews and the usability tests of Vodafone live!.

2 TECHNOLOGY OVERVIEW

This chapter briefly introduces the technology of Mobile Internet. The chapter gives a brief historical overview of how mobile phone systems, Internet and Mobile Internet has developed technically and become what it is today. The chapter discusses the emerging technologies that enable the shift to the Mobile Internet paradigm. We explain the concept of Mobile Internet and present the definition of Mobile Internet used in this thesis.

The technology is according to us not the single most important factor when developing new services or products. It is finally the customer or end user that decides whether a product or service will be used or not. However, not said that technology is unimportant. The technology behind the mobile systems develops rapidly. New mobile systems and mobile phones push the limits of what we as people can do with technology. Certainly technology is an important factor in the Mobile Internet evolution.

2.1 Mobile systems

The technical development within mobile industry has progressed more rapidly the last decades. The very first mobile call was made in Sweden in December 1950; the call was made to the speaking clock service (Fröken Ur). In April 1956 the first automatic mobile phone system was launched by the company Televerket in Sweden. The system was called Mobiltelefonsystem A, MTA (Mobile Phone System A). In the year 1969 the system was liquidated due to its cumbersome size and expensiveness and was replaced by the newer system Mobiltelefonsystem B, (MTB). The mobile phones were now slightly smaller, more light-weighted and less expensive, but the system still had its limitations (Mölleryd 1997).

In 1969 a group was appointed, Nordiska Mobiltelefongruppen, NMT (The Nordic Mobile Phone Group) to work with a common Nordic system for mobile communications. It took the group twelve years to accomplish their task, in October 1981 the mobile system NMT 450 became reality. One year later, the system had 35 000 subscribers in the Nordic countries, and the capacity problem of the net was already a fact. NMT 450 was a success partly because it was the first mobile phone system that worked in different countries. To handle the capacity problems of NMT 450 the development of another system known as NMT 900 began. NMT 900 was launched in Stockholm, Sweden 1986. The NMT 900 was shut down in year 2000 but the NMT 450 exists and is still used by people that are on remote locations where the modern mobile system still not have coverage (Mölleryd 1997).

In 1982 the Conference of European Posts and Telecommunications (CEPT) was founded to establish a standardised system for the second generation of mobile communications (2G). GSM which was the result of the work is an abbreviation for Global System of Mobile communications and is the largest standard for mobile communication worldwide. The system is digital which enables for possibilities for data based mobile services. GSM has a bandwidth of 9,6 kbit/s which is quite slow for users that would like to use the GSM network for data transfers and other services than making phone calls. GSM was introduced in several west European countries including Sweden, in 1992.

To compensate for the low bandwidth in the GSM networks, different upgrades have been done to the standard. One of the most known upgrades is Global Packet Radio Service (GPRS). GPRS has a theoretical bandwidth of 115 kbit/s and has the ability to be online all time, which enables fast access to mobile services (Ericsson 2003). Since GPRS is a complement to ordinary GSM and is developed for data transfer only; the GSM is still used to handle the talk. GPRS, also known as 2,5G is of many considered to be the technological basis of what we today describe as Mobile Internet since GPRS allows users to be online at all time. Another technology, not yet implemented in Sweden though, is Enhanced Data for Global Evolution (EDGE), which has a bandwidth up to 384 kbit/s (Ericsson 2003).

Today the third generation of mobile communications, 3G, is under development. 3G is to greater extent adapted to mobile data services and also facilitates higher bandwidth. In Europe the standard for 3G is UMTS, Universal Mobile Telecommunications System. The theoretical bandwidth of this technology is 2 Mbit/s (Ericsson 2003). Even further into the future 4G systems will emerge including standards like HiperLan2, which offers even higher bandwidth, up to 54 Mbit/s (Ericsson 2003). Important to understand though, is that the major technology shift, from a Mobile Internet perspective, takes place when we start using GPRS. Some people even refer to GPRS as the revolution and UMTS as an evolution (Ericsson 1998).

An important part of the mobile revolution is the mobile devices used for communication. Today there exist several different types of mobile devices able to connect to the Mobile Internet in some way. Mobile phones are still the most common device but PDA's and combined smart phones are getting more common. An example of these new smart phones are the latest combination of mobile phone and PDA developed by Sony Ericsson, the Sony Ericsson P800 (see figure 2.1). These new mobile devices are becoming more sophisticated and offer its users a wider range of application. The emergence of stylus pen based in combination with larger screens on mobile devices opens new ways of using mobile application and also new ways of interacting with mobile web based services.

Figure 2.1. Sony Ericsson P800.

2.2 Internet

The first recorded description of the social interactions that could be enabled through networking was a series of memo written by J.C.R. Licklider of MIT in August 1962 discussing his "Galactic Network" concept. He envisioned a globally interconnected set of computers through which everyone could quickly access data and programs from any site. In spirit, the concept was very much like the Internet of today. Licklider was the first head of the computer research program at DARPA, starting in October 1962. While working at DARPA he convinced his successors at DARPA, Ivan Sutherland, Bob Taylor, and MIT researcher Lawrence G. Roberts, of the importance of this networking concept (Leiner et al. 2000). The more tangible history of Internet began in 1969 as an experiment made by the department of defence in the USA. The experiment was originally conducted to see how reliable a network could be and how the traffic could find new ways if one link in the network would be destroyed by an enemy. The first net developed was

called ARPANET and linked the department of defence, military research companies and a few universities together.

In October 1972 Bob Kahn, the Director of DARPA's Information Processing Techniques Office, organized a large, very successful demonstration of the ARPANET at the International Computer Communication Conference (ICCC). This was the first public demonstration of this new network technology. It was also in 1972 that the initial "hot" application, electronic mail, was introduced. In March, Ray Tomlinson at BBN wrote the basic email message send and read software, motivated by the need of the ARPANET developers for an easy coordination mechanism. In July, the MIT researcher Lawrence G. Roberts expanded its utility by writing the first email utility program to list, selectively read, file, forward, and respond to messages. From there email took off as the largest network application for over a decade. This was a forerunner of the kind of activity we see on the World Wide Web today, namely, the enormous growth of all kinds of "people-to-people" traffic (Leiner et al. 2000).

The ARPANET was very successful and all the universities that did not have access to it later wanted to join the network. When this happened they divided the ARPANET into two different networks, MILNET for the military part and a new ARPANET for the non-military part. Both networks could communicate with each other through the Internet Protocol (IP). This happened in 1984. The next milestone for Internet were when National Science Foundation (NSF) funded a number of first-rate computers for research purposes and let scientists all over the USA use ARPANET to connect to these computers. The use of ARPANET to connect to the computers proved not to be the best solution and NSF decided to build there own, better and faster network, NSFNET. Around 1990 most of the traffic moved to NSFNET which lead to ARPANET was shut down.

Internet became public in 1991 and in 1993 World Wide Web was introduced (W3C 2000). Today Internet is the world's largest computer network or more exactly, a network made by networks. Today the Internet is used for a multitude of services ranging from information and entertainment to communication and commerce. E-mail is one of the most used functions and the value of this function increases as more people get connected. The services on the Internet have created a great need for a new kind of communication - data communication. Internet has caused a major revolution in the information society and today more than 600 million people are connected to the net (NUA 2002).

The Internet has revolutionised the computer and communications world like nothing before. The invention of the telegraph, telephone, radio, and computer set the stage for this unprecedented integration of capabilities. The Internet is at once a world-wide broadcasting capability, a mechanism for information distribution, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location. One should not conclude that the Internet has now finished changing. The Internet, although a network in name and geography, is a creature of the computer, not the traditional network of the telephone or television industry. It will, indeed it must, continue to change and evolve at the speed of the computer industry if it is to remain relevant. It is now changing to provide such new services as real time transport, in order to support, for example, audio and video streams. The availability of pervasive networking (i.e., the Internet) along with powerful affordable computing and communications in portable form (e.g. laptop computers, PDA's, mobile phones), is also making a new paradigm of nomadic computing and communications possible (Leiner et al. 2000).

2.3   Mobile Internet

The Wireless Application Protocol, also more known as WAP, can be said to be the first glimpse of what Mobile Internet services can offer. WAP is a protocol for accessing information and services from mobile devices. The WAP standard is defined and coordinated by the Open Mobile Alliance (OMA) formerly called WAP Forum. Open Mobile Alliance is a consortium of industry players who have an interest in extending the kind of information and services that we have become used to accessing over the Internet, to users of mobile devices, including mobile phones. Founded by Phone.com (today known as Openwave), Ericsson, Nokia and Motorola, the members of the Open Mobile Alliance include most of the now leading corporations in the industry, including all the major handset manufacturers, network operators, and software companies. The objective with Open Mobile Alliance is to define a standard application framework that will be universal, and that will allow seamless interoperability of all of the components required for mobile access to network applications (Open Mobile Alliance 2003).

The first version of WAP, WAP 1.0, was presented in April 1998. But it all began in 1995 when Ericsson released a project to increase the number of services for mobile networks. The goal was to develop a general protocol for services on mobile networks. The protocol that they later developed was called ITTP – Intelligent Terminal Transfer Protocol. ITTP was able to manage the communication between an application and a mobile phone. The goal was that ITTP should be the standard for services on mobile networks (Nokia 1997). During 1996 and 1997 other companies for example Nokia and Unwired Planet, introduced similar solutions to manage services on mobile networks. Unwired Planet presented Handheld Device Markup Language (HDML) and Handheld Device Transfer Protocol (HDTP). HDML is used to describe the content and the user interface of the page. It is similar to HTML but is optimised for wireless communication. In the same way HDTP is a kind of version of HTTP, used for client/server transactions (Nokia 1997). Nokia's solution was called Smart Messaging concept and was specially designed for GSM-phones. The communication between the phone and Internet was handled by SMS-technique and a markup language called Tagged Text Markup Language (TTML) and it worked the same way as HDML. In this stage when there were several concepts for mobile networks on the market, the companies realised that products with different solutions would not work together and that none of the companies would gain on this. To prevent this incompability between products the companies got together to develop a standard for wireless communication. This cooperation led to the release of WAP (Nokia 1997).

In every WAP-enabled mobile phone today there is a WAP-browser. The WAP-browser lets the user browse WAP-pages. Today WAP exist in different versions, WAP 2.0 is the latest version and it enables WAP-pages to be viewed in colour and developed using a version of XHTML, known as XHTML Mobile Profile. One of the biggest news in WAP 2.0 is that it converge with the ordinary Internet. By using a common format, XHTML, it makes easier to adapt Internet applications to WAP. WAP 2.0 also enables MMS, text messages combined with sounds and images (Open Mobile Alliance 2003).

In addition to WAP-browsers there exist different browsers for mobile devices for accessing ordinary web. Some of the mobile devices support browsing ordinary web pages using standalone software. Some of the mobile web browsers today are Opera, Microsoft Pocket Internet Explorer and Teleca Obigo. Some of the browsers use a technique to adjust a normal web page to the smaller format of a

handheld device; other browsers simply let the users scroll the page both vertically and horizontally. It is also a difference in what browsers are capable of handle, most browsers cannot handle frames on web pages, and some browsers do not support JavaScript.

Opera 6.00 is a web browser primarily designed for the mobile phone Sony Ericsson P800, but recently Opera released a version of their web browser designed for Nokia 3650 and Nokia 7650. Opera uses a technique called SSR (Small-Screen Rendering) and reformats the presentation of web pages made for the desktop web to fit on a smaller screen (see figure 2.2), eliminating the need for horizontal scrolling. Opera supports the latest standards including HTML 4.01, JavaScript 1.5, and XHTML 1.0/1.1 (Opera 2003).

Figure 2.2. To the left is a screenshot of an ordinary web page from a Swedish newspaper. To the right the same web page is viewed through Opera using SSR to compress the page to a mobile format.

Another type of mobile web browser is AvantGo. AvantGo is an offline browser for Palm and Pocket PC devices. AvantGo enables users to download chosen websites, adjusted for the mobile device, when synchronising the handheld device with a computer connected to the Internet. After synchronising users are able to browse downloaded web pages offline on their handheld device. Since AvantGo is a limited offline version of the Internet it is perhaps not always seen as true Mobile Internet, it still lets users and developers experience one way of Mobile Internet (AvantGo 2003).

Despite the simple understanding from the term *Mobile Internet*, it has a much broader meaning and often entails several different technologies and concepts for different people. In this thesis, we will use the term Mobile Internet with the definition as "the use of Internet services via handheld devices such as mobile phones or personal digital assistants". This definition of Mobile Internet is similar to the definition used by Merrill Lynch (2000). One should also know that laptops using GPRS or Wireless LAN also can be seen as use of the Mobile Internet,

though we have focused our work on the use of handheld devices to access web based services.

3 EMPIRICAL WORK

In the following chapter we intend to describe the methods we have used for this study. The research methodology is discussed for the reader to be able to better assess the content of our work. As we are looking into the future we seek to find the nature of the phenomenon of Mobile Internet and then form an opinion, that is, make an explorative study. This exploratory method implies that the investigator makes a field study within the environment where the phenomenon exists. In our case our field study has been done through our work as interaction designers at Doberman, by doing literature studies and finally by using different qualitative and quantitative methods for collecting data.

3.1 Qualitative and quantitative methods

There are two main courses when it comes to collect and work with data, qualitative and quantitative methods. The method descriptions, quantitative and qualitative refer to how you select to gather, study, and analyse the information being collected (Bell 2000, p. 13). The difference between a qualitative and a quantitative method can be seen in different ways and levels. During the research the difference can concern what is being investigated, if it deals with opinions and content or if it deals with measurable reactions. The quantitative method means that you analyse the collected data with different statistic methods and the qualitative method is used when you want to have a deeper understanding of the problem at hand (Andersen 1998, p. 31).

Qualitative data focuses on in-depth information based on data not easily measured, such as attitudes, values and perceptions. The aim of the qualitative technique is to study several variables in a small group of respondents. In qualitative methods it is often the process that is of interest, which means that the important thing is what really is happening. It is also of interest to investigate people's experiences and how these experiences are interpreted. Characteristic for the qualitative method is that it includes field work, which means that different people, situations or locations are inquired (Andersen 1998, p. 31).

In quantitative research it is common to use statistics and mathematics (Andersen 1998, p. 31). The collected data is mostly expressed in numbers which leads to a concretisation of assertions and opinions that have been brought to light during the research, this so they can be measurable (Svenning 2000, p. 67). Using a quantitative technique, variables are studied in a large group of respondents. The most important difference between the two types of data, qualitative and quantitative, is that when using a quantitative method the researcher has to be objective and use standardized questions to be able to compare the results. When using a qualitative technique the researcher is supposed to be more flexible and adjust the questions in order to receive a deeper understanding.

In our research we have conducted interviews together with usability tests and a survey. According to Patel and Tebelius (1987, p. 102) interviews and surveys have two dimensions, *standardisation* and *structure*. The level of standardisation has its origin in principles of measurement. If the level is high it means that the interviewer asks the same questions in the same order to all the interviewed persons, and if the level is low the interviewer for example can ask the questions in an order that is suitable for each interviewed person and situation, and the questions do not need to be exactly the same (Patel & Tebelius 1987, p. 103). If an

interview has a high level of standardisation it is the start of making a survey. In a survey all the persons answers the same questions in the same order. The level of structure shows in the size of the area where the respondents answer can be found. A highly structured interview has a curt answering area and you can almost foretell the different alternative answers. In an unstructured interview the answering area is unlimited and the answers can be just about anything. If you relate the level of structure to surveys, surveys with fixed answers are highly structured and survey with open questions less structured (Patel & Tebelius 1987, p. 103).

Depending on how you combine the level of standardisation and the level of structure you get different types of interviews and surveys that have different areas of use. The table below (figure 3.1) shows the different types you can get from combining these aspects (Patel & Tebelius 1987, p. 103).

	Structured	Non Structured
Standardised	Questionnaire with fixed answer alternatives If you wish to quantify the results	Questionnaire or interviews with open questions
Non Standardised	Focused interviews	"journalist"-interviews If you like to make a qualitative analysis of the results

Figure 3.1. Table describing two different dimensions of surveys and interviews (Patel & Tebelius 1987, p. 103).

Our survey had a high level of standardisation and also a high level of structure and our interviews had a low level of both standardisation and structure. With our survey and our interviews we find our self in the upper left corner and in the lower right corner of the table. We have chosen these different types of methods because we want to look at the problem area from different angles and by that hopefully get a broad view of users' apprehension, experience and thoughts of Mobile Internet.

To have good and correct data you have to think about some parameters when collecting the data, they are *applicability*, *reliability, correspondence* and *accuracy* (Patel & Tebelius 1987, p. 68). The first parameter, applicability, means that your technique for collecting data and the group of respondents must be useful and fit your purpose. The more the respondents are motivated and interested in the subject in matter the more the reliability increases. It also increases when you use a large spectrum of respondents, which is one reason why we have chosen to use a survey to collect information. When you present the data you have collected, it is very important to do it in a correct way so the result does not show a distorted view of the real world. This means high demands on a suitable way of collecting the data. Correspondence is about how well the data matches the problem examined. In our survey we had questions which were directly related to our research questions. The level of accuracy shows how well we have managed to be consistent throughout the whole collection of data. It also measures our carefulness for example when it

comes to the selection of expressions and terms and our honesty during the data collection.

With the combination of interviews and a survey we have done our best to fulfil these criteria's. The methods have been a complement to each other, we have reached numerous respondents with our survey and we have interviewed people to get a more varied and deeper view of users' opinions. The same could be argued with the reliability of the research, with the survey we reached a broader group of people then we could have done with interviews, thus getting a broader spectrum of respondents.

3.2   Survey

To get a broader understanding of what users of today think of Mobile Internet we conducted a survey. The main purpose with the survey was to find out users experience and attitudes of Mobile Internet today. A second purpose was to see differences in attitudes towards Mobile Internet between different types of user groups, for example user groups based on differences between users' interest in new technologies. Finally we were also interested in which Mobile Internet services the respondents used today and which services they were missing.

When we conducted the survey we used a web based tool to design and administrate the work. The tool was used to design and distribute the questionnaire, but also to gather and analyse the data collected. The web based tool was supplied by a research company, Easyresearch (http://www.easyresearch.se), which we got in contact with during our work. The questionnaire we distributed consisted of 18 questions and free comments at the end. A hyperlink to the web based questionnaire was sent via e-mail to 150 respondents. Since we wished as many as possible answered the questionnaires we selected respondents that have some relation to the authors, either work, education or spare time related. In total 116 (77 %) of the respondents answered the questionnaires. The key findings of the survey are presented and discussed further in the following chapters; the collected data can also be seen in appendix B – Survey results.

3.3   Interviews with users

When we performed the usability tests, which are discussed in chapter 3.4, we combined these tests with our interviews. In all we performed eight individual interviews and tests with eight different respondents. For the tests and interviews we selected people with different backgrounds, different genders and people of different age, which were all somehow acquainted with us. The interest and knowledge among the respondents concerning new technologies, such as Mobile Internet also differed greatly.

We conducted the interviews before the usability test not to risk that the test persons would get influenced of the service they would test. This because of that none of our test persons had any experience with Mobile Internet in the way the tested service Vodafone live! offers it. The interviews, which were rather more like discussions, focused on the users' experience and thoughts of Mobile Internet of today and what they thought and hoped Mobile Internet would be in the near future. Our choice was to have open-ended questions written down to help us follow approximately the same discussion area with all the test persons. The written questions gave us support if we got lost in the discussion. It was important to us that the participants could feel that they also helped forming the discussion so

they would not feel to distracted and focused just on the specific questions. The interviews were in our case not about getting the most accurate or complete understanding of the topic but to acquire a better understanding of what the interviewed person knows and thinks about the topic (Blomberg 1993).

3.4   Usability testing

The overall goal of usability testing is to identify and rectify usability deficiencies existing in computer based and electronic equipment. The intent of usability testing described by Rubin (1994, p. 26) is to create products that are easy to learn and use, are satisfying to use, provide utility and functionality that are highly valued by the target population. There are several methods of conducting a usability test.

Some examples of different types of tests are exploratory, assessment, validation, and comparison tests. (Rubin 1994, p. 30) The exploratory and assessment tests are conducted early or midway into the development cycle, the validation tests are conducted late in this cycle, and comparison tests can be done anywhere in the cycle.

The main purpose of exploratory tests is to examine or explore preliminary design concepts, also known as the mental model of the product. The assessment tests is a prolongation of the prior test and evaluate how well the mental model from the exploratory test has been implemented, it is interesting to see how well a user actually can perform a realistic task and that he or she identify shortcomings in the usability of the product. The objective of validation tests is to determine how the product fulfils the demands or standards that were set up, and if not establish the reasons why. Another objective is to evaluate how the products different components work together and how they are integrated with each other. The comparison tests can be used together with the other tests and make a comparison between different designs alternatives. With comparison tests it is possible to determine or understand advantages and disadvantages of different designs (Rubin 1994, p. 31).

Figure 3.2. Sharp GX10 with Vodafone live!

The usability tests we performed were a type of validation tests. Our primary objective was not to design or change a product but to understand users experience and feelings when using the service tested. The service we tested was the Mobile Internet service Vodafone live! (see figure 3.2). Central to this service is the mobile WAP portal which provides colour, icon-based navigation using GPRS-connections for data transfers. Vodafone live! is an aggregation of mobile applications and services that was launched across Europe in October 2002. The users of Vodafone live! are able to access a wide range of applications and content services such as news services, download sections, messaging applications, for example, E-mail, MMS and Chat. An important part of the Vodafone live! concept is that every phone that are sold together with a Vodafone live! subscription are equipped with a shortcut button to the Vodafone live! portal and that the Internet settings are preconfigured. This means that a user easily can start using the Vodafone live! services without any previous knowledge of WAP settings or WAP

use. As Vodafone live! is an example of what Mobile Internet could be today this usability test also suited well to get users' opinions of what they think of Mobile Internet today.

The usability test was performed as an observation test (Nielsen 1993, p. 186). In an observation test the user does a few tasks or uses the software or service as usual and the observer takes notes of what she does. Our usability test was based on four different scenarios which were related to use of the Vodafone live! service. Our choices of scenarios were based on situations that can occur in everyday life. The scenarios comprised of various services provided by Vodafone live! and consisted of playing games, access news services, download ring tones and to get information about a movie shown at a local cinema a certain day. The test was carried out using the Vodafone live! compatible mobile phone Panasonic GD87. Panasonic GD87 is a mobile phone with clamshell design equipped with a colour display and a 5-way navigational key and are similar to the Sharp GX10 (see figure 3.2). To ensure that the usability test wouldn't be focused on the use of the mobile phone we demonstrated and explained to the persons being tested, how to use the menus and the navigational key.

During the observation test it is an excellent method to encourage users to talk out loud what they are doing and thinking. When verbalising their thoughts it can be discovered how users perceive the service and also perhaps determine any misconceptions. Of course, not everyone feels comfortable talking aloud, which is one of the disadvantages with this kind of tests. If the user becomes silent the observer can ask the user what she believes something means or tell the observer how she experience the current situation. We chose to use this think-aloud protocol for our test sessions and during the test we took notes on the behaviour, which choices the test person did and things the user said. In some cases we also used a video camera to record the test, to use it as notes (Blomberg 1993), like a supplement to our written notes or when memory failed. When using the think-aloud protocol it is important to not only listen to what the test persons say but also to see what the test persons actually do. What the user says *while* doing the test is also often more useful in a usability point of view, than what the user says *after* the test (Nielsen 1993, p. 195).

The observation tests should take place in a normal situation for the user. Therefore one should not give help to the user since she normally does not have an expert in the room to ask. It is good if the test can be conducted in the users' own environment, which makes it easier to reveal the users' tasks. When we performed these usability tests out of context, for example in the home of the test person, we missed some important aspects, mainly related to mobility. This omission of context is something which we are aware of and have tried to compensate by presenting describing scenarios that the user could relate to.

After the test was finished we asked the test person to fill in a questionnaire based on the System Usability Scale (Brooke 1996). When using the System Usability Scale it is possible to calculate a numeric value of the test person's apprehension and experience of the service and compare it with other users and/or with other services. The main purpose of SUS is to register the users' subjective impressions of the usefulness of different types of products or services. The questions asked are related to the experienced usefulness of the product.

The primary intention when Brooke developed the SUS questionnaire was to get a quick and easy method to test subjective usefulness. To produce the questions that were most decisive, fifty questions were selected. The fifty questions were then

used in several usability tests. Out of the fifty questions the ten questions that gave the clearest response were selected. The ten questions in the SUS questionnaire shall be answered like a Likert scale (Barnett 1991). A Likert scale is used to assess the support or dissociation to a specified statement. The scale is divided in five steps and the outermost answers are "Strongly agree" and "Strongly disagree". Every other question has the positive answer as the best answer in a usability point of view, every other the negative. The reason is to try to avoid that a test person fills the questionnaire in a routine-like fashion without reflecting about what the questions really say.

4 MOBILE USE

In this chapter we present the area of mobile use and describe different types of mobility and what mobile means for a user. We also discuss how Mobile Internet relates to Internet and what users' apprehension and experience of Mobile Internet is today.

Laptops are today a part of a normal workday, mobile phones are to many an important element in our society and PDA's are beginning to emerge more and more. These information technology tools, artefacts, together with an increased self-governing make our work, and our private life becoming more flexible when it comes to where and how we perform given assignments. To develop support for our increasingly mobile behaviour an understanding of the opportunities and limitations which it involves is demanded (Lindroth & Östlund 2001). To be able to develop services adapted for mobile use it is important to know what mobile use actually means and how it affects the design of a product or a service.

4.1 Mobility

There are several different ways of describing and categorise different types of mobility. Kristoffersen and Ljungberg (1998) provide, in their study, designers with a framework of concepts allowing to understand and discuss how people use information technology in mobile settings. They also claim that this framework will help designers to invent new concepts and imagine new metaphors for mobile settings. Kristoffersen and Ljungberg present a model for mobile use situations consisting of three main dimensions: surroundings, modality and application (see figure 4.1). The surroundings (environment) consists both of the physical surrounding but also the social environment where the use situation occur. The modality refer to how an activity is carried out, both concerning mobile and stationary activities. Application consists of three parts, technology, program and data. The technology is the hardware platform and can for example be a mobile device, such as a PDA. The program is the software that the user interacts with and the data is the information the user provides to the software.
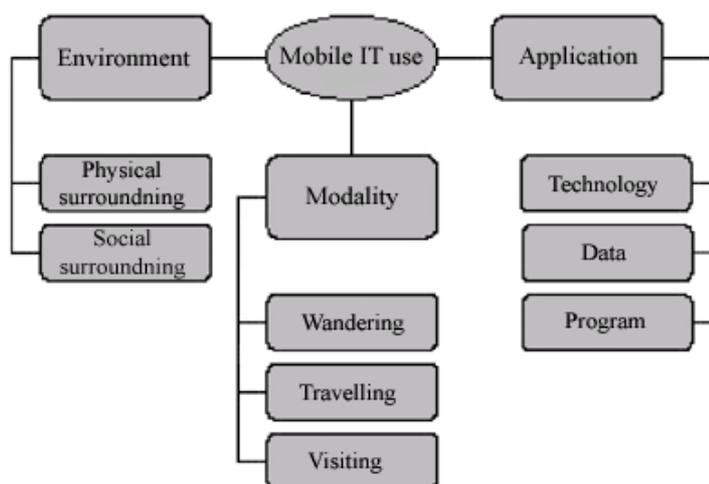

Figure 4.1. Model of mobile use situations (Kristoffersen & Ljungberg 1998).

Surroundings are divided in two parts, physical and social surrounding. The physical surrounding is the situation where information technology is used and

which is observable. An example of the physical surrounding is the interior in a bus. The physical surrounding has great affect in how we use information technology, for example if there are not any available seats on the bus it makes use of mobile information technology much more difficult. The social surrounding is not equally tangible, it consists of formal structures as for example rules and informal structures as culture and power.

The modality dimension of mobility describes three different archetypes of mobility, wandering, travelling and visiting. Wandering is a mobile state which means that some movement within a local area, for example a building occurs. An example could be a person that works as computer technician in a large company. Travelling is a mobile state where a person travels to a predetermined destination. The destination is more important than the journey itself. A traveller can either be a driver of a vehicle or a passenger. It can be a commuter on her way to work or it can be a family on their way to a holiday resort. Visiting, which is the third term, means that a person spends a certain amount of time on a determined place before she moves on towards new places. An example can be a consultant on an assignment at a client's office. When the work is finished the consultant leaves and gets back to her ordinary office.

A second way to divide users into mobile categories is to divide them into different roles (Bergquist 2002). Nomads are the first type of people. Their movements are unpredictable; their destinations can be decided on the way and can change rapidly. Examples of nomads are consultants with international assignments. They have a base somewhere but they are out travelling most of the time. The nomads require services that support action in situations that are hard to plan in advance. They can not rely on an established infrastructure. Their way of communicate and get information is build upon solving problems and to create occasional networks, all according to the situation at hand. The pilgrims are a group of people that moves in a more predictable way, with apparent places to stop on – a simple example is a postman. They can in a different way be supported by the infrastructure, since they stop on places where they can access major information more easily. The pilgrims want services that contribute that their goals are achieved. The need of services is greatest when something happens that differ from the predictable. The tourists are a group for which experience and entertainment are the most important aspects. The people in this group are often restless and unpredictable. They want to be surprised and moves unplanned, they seek themselves to places no one else seek. They are open for impressions that change the conditions in an exciting way. The kinds of service they demand have to be locally adapted and focused on pleasure rather than usefulness.

When the word mobility comes around it is often associated with people that are on the move. In the article presented by Lindroth and Östlund (2001) it is not assumed that mobility is the same as movement. Rather, that it relates to the possibility to move oneself independent of what you are engaged in. Mobility means different things depending on which context you see it in and how one approach the conception of mobility. To be more concrete concerning mobility, mobility can for example be interpreted as being away from home, and your stationary computer. It means that mobility not necessarily is about being in motion but about being away from those resources you normally have access to, or being away from the place where you normally are. This idea presented by Lindroth and Östlund was supported by results from our survey regarding Mobile Internet. On the question "Where/when do/would you primarily use Mobile Internet services?" (see appendix B, p. 14) some of the open answers were: "Everywhere", "When needed,

not depending on place but situation" and "When I'm mobile, i.e. NOT having access to a stationary PC".

4.2   Internet and Mobile Internet

Mobile Internet is considered to be significantly different from the stationary Internet in two important aspects (Kim et al. 2002). First, Mobile Internet can be used in various contexts, whereas stationary Internet is mostly used in predetermined environments. For example, because of its portability and intimate connectivity, Mobile Internet can be readily used on the road while in one's car or anywhere else. In contrast, the stationary Internet has been used mostly in limited contexts such as in an office or at home. Second, Mobile Internet usually comes with more limited system resources than the stationary Internet. For example, Mobile Internet has much smaller screens, less convenient input devices, and much slower networks.

One of our research issues in this thesis was to find out how do today's users apprehend and experience Mobile Internet and what the main differences between Mobile Internet and Internet are. Users' apprehensions of the differences between Internet and Mobile Internet, which were discussed during our interviews, proved to be quite divergent (see appendix C, p. 4). One respondent expressed that "I do not see any major difference between Internet and Mobile Internet. It is the same net; it is only different types of computers (clients)" another respondent expressed that "Internet and Mobile Internet feels like two different things" and a third respondent said "I do not really see WAP as a part of the Internet". The main advantage of Mobile Internet in relation to Internet according to our survey (see appendix B, p. 16) was not surprisingly, the possibility to always access Internet services independent of location and context. The second most important advantage was the possibility to make use of position based services. The main disadvantage of Mobile Internet, which was mentioned frequently by our respondents, was the "tiny user interface" on mobile devices.

During our work we have identified that many users use the ordinary Internet on a daily basis and that Internet is used for many tasks concerning the everyday life such as banking, checking timetables, communicate with friends etc. Since banks and postal offices are closing down local branches and governmental functions sometimes are most easily accessed over the Internet, it makes the use of Internet for ordinary daily tasks more common. This use of Internet as a part of everyday life can be seen as a part of an individual's personal infrastructure and can be compared to the use of phone and mail. One possibility is to also regard the Mobile Internet as a part of an individual's infrastructure the same way the fixed Internet is an infrastructure. In that sense Mobile Internet would be a mean of reaching various people and services across the network. An interesting aspect related to Internet and the stationary computer as personal infrastructure was that nearly all of the respondents in our interviews mentioned that they would like to have the possibility to access the computer at home by using a portable device when being mobile.

4.3   Internet going mobile?

The use of the ordinary Internet is not irrelevant when developing services for mobile use. It may very well serve as an inspiration to what kind of services may become used and be appreciated. To some extent we can see the same basic qualities in Mobile Internet in terms of ubiquity, availability, freedom and

boundlessness. With Internet as a role model and mobility as a central factor, we may see a number of upcoming innovations like messaging, information and entertainment. A majority of people in Sweden are conceptually familiar with these web based services and will only have to learn how to use the tool (terminal). It should be noted however, that even if conceptually familiar, an innovation might be troublesome.

If we were to use the Internet as a source of inspiration we can take a look at the major applications on the Internet today. The major usage of Internet today is research of some kind. Another major usage is communication, both via e-mail or instant messaging. In our survey we asked our respondents what kind of Mobile Internet services they would like to have access to (see appendix B, p. 15). E-mail was the service that most users wanted, which confirms that users see communication as an important element in future Mobile Internet usage. During our empirical work we have found out that a major part of the respondents, both regarding the survey and the interviews had hopes for a mobile full version of the Internet, that is, being able to access all web based services from a mobile device. By using communicators as Sony Ericsson P800 and web browsers adapted for mobile use, for example Opera 6.00 users today have the possibility to access most web based service. Will the development of devices together with new versions of mobile web browsers make the Internet truly mobile?

5 USERS - WHO ARE THEY?

When developing services or products it is important to know for whom you design. This chapter discusses different user groups and their relation to a new product or technology. Mobile Internet which can be seen as a new technology or innovation will be adopted by different user groups and in different ways.

In the early days, a new technology such as Mobile Internet, can not meet all the needs of its customers. The early adopters are willing to suffer inconvenience and high cost to get it. Meanwhile, they keep demanding better and better technology, higher and higher performance. With time, the technology matures, offering better performance, lower price, and higher reliability (Norman 1998, p. 31). When technology is good enough it becomes irrelevant and the user experience dominates.

5.1 From innovators to laggards

There are different ways to categorize users into groups. Rogers (1995, p. 263) and Norman (1998, p. 31f) though both talk about five different categories of users; innovators, early adopters, early majority, late majority, and laggards (see figure 5.1). Each of the user groups plays a different role in the development of a new technology or product, with the innovators and early adopters driving the technology and the early and late majority sitting on the sidelines, waiting until it is safe to jump in (Norman 1998, p. 31f).
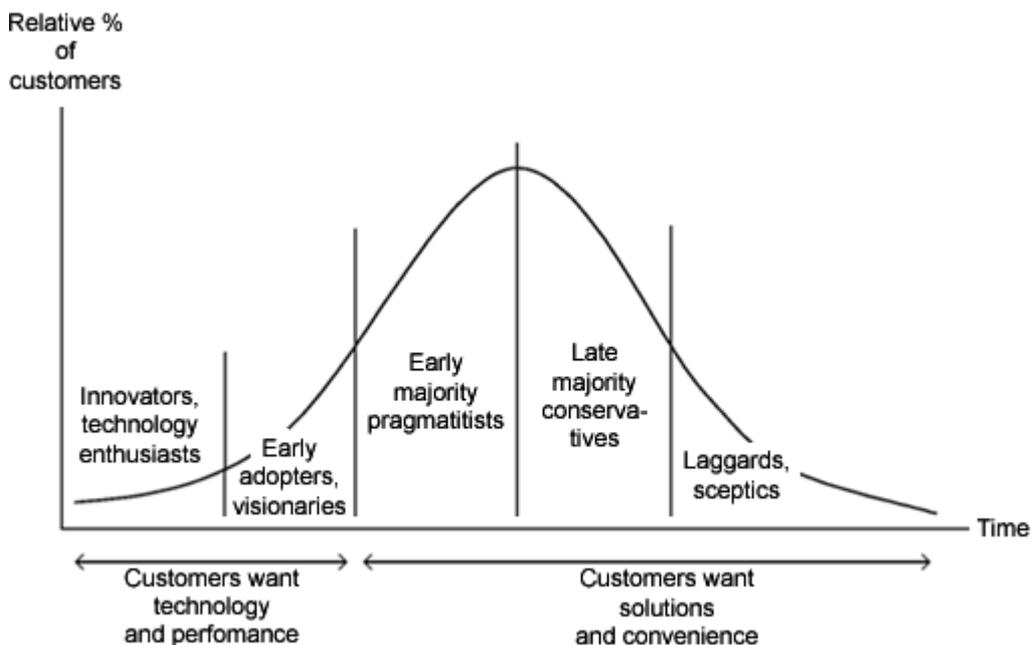

Figure 5.1. The change in customers as a technology matures (Norman 1998, p. 33).

The innovators are eager to try new technologies and they know that there can be some adversities as they try new approaches and they are not to be intimidated if their choice of action proves unsuccessful (Rogers 1995, p. 263). The people who buy a new technology in its early days are called early adopters. They buy it because they really like technology and will buy almost any new product, their

needs for the newly developed technology and functions are so great that they are willing to put up with the problems that can occur (Norman 1998, p. 25). Early adopters has a kind of leadership when it comes to the technology in hand, this means that other users of the technology looks at the early adopters ideas and asks them for advice and information about the new technology. These are the people that set an example for other users and increase others confidence about adapting to a new technology (Rogers 1995, p. 264).

Norman also talks about when technology reaches a certain point where it satisfies basic needs, then improvements in the technology becomes less important and customers seek efficiency, reliability, low cost and convenience. Moreover, new users keep adopting the technology as it matures. In the early phase of a technology we have the early adopters, those who are willing and want to try the new technology because they feel that the benefits exceed the costs. More conservative customers hold back, waiting for the technology to prove itself, to become reliable (Norman 1998, p. 31).

The early majority is cautious toward change, new technology or towards new ideas. It is unusual that they advocate change efforts, but they are not strangers to adopt new ideas and technology. The users that fits in the group of late majority looks at change and new ideas with scepticism but they feel pressure to accept it from other users that already has adopted the innovation. When the last group, laggards, adopt a new innovation they have the past as their point of reference. The adoption takes time because of their lack of interest and awareness of new technology and when they finally adapt to it, it is likely that the innovators already has introduced another idea or innovation (Rogers 1995, p. 264f).

5.2   Product turnover

The majority of users are in the predefined groups; early and late majority. Therefore there is of interest to attract these users to use the new technology. If this is done the product has its place in the market. But how is this done? There are different views how to attract the majority of users to the new technology. Everett Rogers have showed that innovation spread slowly, with early adopters being different kinds of people than late adopters. G. A. Moore (1991) talks about a company that had to change its behaviour and its marketing as the customer base changed. Norman means that in addition to this, the product has to be different. It is not enough to change the marketing; the entire product must change to fit the new user groups (Norman 1998, p. 274).

In our research we have divided users into two main groups depending on their interest in new technologies. We have based our two groups on what the test persons mentioned in the interviews and what our respondents answered in our survey. These two groups are similar to the groups presented by Norman and Rogers. Group A, which we have chosen to call the group of people with highest interest in new technologies, corresponds to the groups innovators and early adopters. The users in group B correspond to the groups early and late majority.

In our thesis research we have found results supporting Norman's thoughts and ideas; users in the different user groups have different views on their own usage of Mobile Internet and their view on the subject differs a lot. Users are interested in different products, and these products and technologies have different usage areas. There have to be a change in the product before the majority takes it to their hearts and start using it. But is the technology mature enough? When the technology

begins to mature there will be easier to develop products that fit the demands the majority of users have.

In our survey we found that the use of Mobile Internet services were concentrated to users in group A (see appendix B, p. 22), which consisted of the respondents interested in technologies. 48 % of the users in group A had occasionally used Mobile Internet. In comparison, the number of users in group B that occasionally had used Mobile Internet was less than 15 %. To make a new technology such as Mobile Internet attractive for users in group B the technology must mature and focus on basic user needs instead of the technology itself. As it is today Mobile Internet does not really attract users in group B and only half of the users in group A which would, according to the diagram presented by Norman, roughly mean that the innovators and half of the early adopters have adopted the new technology of Mobile Internet. This in turn means that Mobile Internet has to mature even more before it is adopted by the great mass, early and late majority.

6 QUALITY OF USE – WHAT MAKE USERS USE?

Until this chapter we have discussed mobile use and different user groups concerning the use of Mobile Internet. The third and final factor to consider when discussing Mobile Internet from user centred perspective is what actually makes a user want to use a product or service. In this thesis we have chosen to call this essential aspect for quality of use.

6.1 Definition of quality of use

Larry Keeley of the Dublin Group has created an intriguing conceptual model of three primary qualities in high-technology business (Cooper 1999, p. 72). Keeley calls the first quality *capability* and it is what technologists bring to the party. They ask, "What are we capable of? What is possible?" Engineers must know what can and can not be built. A product can not be a success unless it can be built and made to work. Keeley calls the second quality *viability* and it is the contribution of business-people. They ask "What is viable? What can we sell?" Business executives must know what can and can not be sold at a profit. A product can not be a success unless it can support a growing company. Keeley calls the third quality *desirability* and it is what designers supply. They must ask "What is desired? What do people want?" Designers must know what will make people happy and satisfied. A product cannot be a long-term success unless it delivers power and pleasure to the people that actually have to use it. Although it is possible to draw out something desirable in an existing product, Keeley believes that is more sensible to first decide on what customers will find desirable and the challenge the engineers and business people to build and sell it.

Another perspective is the one used by Norman (1998, p. 40) who argues that human-centred products need to be balanced very much in the same way as a three-legged stool, where the three legs represent marketing, underlying technology and user experience. Each of the three legs is critical and if one dominates, like in the case of the three-legged stool, there is an unbalance and the product will probably fail. Once again one can use WAP as an example as there has been a focus on marketing and technology, whereas the user experience was compromised.

The quality of desirability or user experience described by Keeley and Norman can also be expressed as the quality of use. The quality of use, as we will describe it, is an important concept and refers to the level that a product or service fulfils and accomplishes the needs, goals and desires of the targeted user groups. Quality of use is a wide range expression and includes two major factors; utility and user experience (Welie & Ridder 2000). Besides these factors, utility and user experience we have identified two more factors which are important to consider when discussing the broad expression of quality of use.

6.2 Utility

Utility, which refers to the subjective value of the service's function to the people that use it, is a crucial aspect of every service and product (Welie & Ridder 2000). Utility briefly means that a user wants to have a service and he or she can see a benefit of using it. This is a subjective value and the user must feel that the service helps them achieve their goals and that the costs of the service in time and money correspond to the benefit of the used service.

When discussing Mobile Internet services with our respondents, services somehow related to utility were mostly mentioned and most respondents of our interviews pointed out that the usefulness of a mobile service was essential for them. Some of the utility related services we found users wanted were:

- Find out where a specific location or a friend is.
- Check timetables for busses and trains.
- Send and receive e-mails or use an instant messaging client such as ICQ.
- Access traffic and weather information.
- See opening and closing hours for shops and different establishments.

These mentioned services can also be compared with the most wanted services according to a study made by the Swedish Post and Telecom Agency (Post- och telestyrelsen, PTS) (Mobil 2003). The top five most wanted services according to their study were:

- A service that shows nearby restaurants and similar, and how to get there.
- Traffic information from the local traffic.
- Possibility to take pictures and make films with your mobile and the send the film or picture via the phone.
- Making video phone calls.
- A positioning service that tells you where friends and family members are.

In our survey the Mobile Internet based services users mostly would like to have access to, were e-mail, bank services, instant messaging and the possibility to browse the ordinary Internet (see appendix B, p. 15). Results from our study showed that people with experience of Mobile Internet (mostly users in group A) wanted more web based services adapted for handheld devices.

To what extent do the services mentioned above help users to achieve their goals from a functional point of view? Do these services offer people functionality that they require or desire? What are the benefits for the people that use these services? These questions address the value and utility of a service. When it comes to Mobile Internet services it easy to relate to ordinary Internet services and the conception of personal infrastructure which were mentioned in chapter 4.2. People today use Internet on a daily basis to simplify everyday life. One respondent said: "I want Mobile Internet services that can make the everyday life easier and the services shall have an obvious purpose" (see appendix C, p. 4). The utility of Mobile Internet are closely related to why people do want to use Mobile Internet services. The most wanted services are preferably used to simplify the everyday life by getting wanted information (e.g. time tables, where a location is, getting traffic and weather information) and by communicate with people (e.g. by e-mail, instant messaging or by positioning people). Mobile Internet could be an additional way for these people to establish communication. Mobile Internet can also be seen like means for users to kill time but this usage area was not that important according to our respondents.

6.3 User experience

The user experience refers to the degree in which people can interact with products satisfactorily. User experience is about how the user interacts with the service. How the product feels. Is it easy to use and learn? Is it fun to use? These are some questions that revolve around the expression user experience. User experience is something more than just carry through specific tasks in an efficient way (Welie & Ridder 2000).

User experience is like utility a subjective value and it can differ a lot among different users and user groups. The early adopters and the majority do not build the user experience on the same basic values; the early adopters purchase their products and services on the basis of technological accomplishments, novelty, and lists of features (Norman 1998 p. 204). Meanwhile the majority of users (early and late majority) build their opinion with things as reliability, convenience, lack of hassle, and costs in their mind.

The two factors, utility and user experience can be combined in different ways. The user experience does not necessarily have to be perfect, but utility must be at a high level, else the service will not be used. A poor user experience can be overcome by offering a high-quality utility, the higher utility value the more users are willing to accept bad user experience (Welie & Ridder 2000). One example is the mobile service SMS; despite the difficulties of writing text with a mobile phone, the benefits of being able to send and receive text messages anywhere and anytime helps to overcome the poor usability.

6.4   Social factors

As information technology artefacts are used outside work, other values than those of work also enters into our conception of what good products or services are. Designers will have to design for different lifestyles, and life-stages. Fashion and symbolism will be more important for consumer products than for working tools. Comfort and togetherness with family and friends will perhaps also be more important than getting things done. Lacohée and Anderson (2001, p. 695) writes:

> "a narrow conception of "user" and "usage" and "usability" will be of little help in understanding how and why people buy, use and dis-use domestic technologies. It has shown how there may be multiple "users" of and multiple "uses" for the same technologies, and that what constitutes usage is defined (or even constructed) by and in a social context."

Communication, which we have identified as one of the main use areas of Mobile Internet, is essential for users to make their social life work. It is also important to consider how young people socialise. This behaviour is a very important way for young people to express themselves and create tight bonds with their social group, social bonding, and new technologies which enables the users to do so in new ways may very well be highly appreciated and frequently used.

A different type of social factor to consider are how people actually think and behave in certain social situations. For example one can not assume that users always want to access services that evidently can be of use. During our interviews we found out that users do not always want direct access to information that would make a situation easier, an example could be when trying to a find a nice restaurant in an unknown city or neighbourhood. A respondent said: "…when I am on vacation half the pleasure is to find that special restaurant on my own, without technology." (see appendix C, p. 4).

6.5   Needs and desires

An individual's need is the answer to perceived dissatisfaction, which in turn occurs when more is required than possessed. This is not to say that an individual cannot develop a need. An individual can develop a need when she learns that an

innovation exists (Rogers 1995, p. 164). Desirability is easy to confuse with need, but they are dramatically different. For example; you desire a six week vacation in Bermuda, but you do not need it. If you have gallstones, you need gall bladder surgery, but it is not something that you desire. In the short term, a person can be powerfully influenced by needs, but over the long term, what people desires always have a way of emerging after their needs are satisfied. When a person needs something, she will do what is needed to get it, but when she desires something, she is loyal to it. She knows that it is a discretionary purchase, and she will buy what makes her happy, and will not necessarily judge rationally. When a consumer desires a product or a brand, her loyalty is one of the strongest forces in business (Cooper, 1999 p. 74).

The benefits of Mobile Internet services as they are presented today will not be obvious to the common users. Who would want to run around pushing the buttons of the terminal all the time? Hence, it is not easy for a user to make the connection between any need felt and what Mobile Internet can offer. All people face daily problems, tiny irritating activities that just have to get done. These are the kind of needs that Mobile Internet hopes to solve, but how this can be done is far from clear to most people. Needs in terms of communication and socialisation may be more obvious as the use of mobile phones and e-mail already is familiar.

The needs among users and user groups are not always the same. There are differences between the early adopters and the majority of users. There is a kind of border between these two user groups; and the producers of a technology or service have to take different attitudes towards the users on different sides of this border (Norman 1998 p. 32). When a technology begins to mature it is easier to fulfil the basic needs of the majority. As mentioned earlier it might be a different product or service that can fulfil the basic needs of the majority than of the early adopters. If the majority of users are going to adopt the technology it is important that the technology satisfy the basic needs of this user group. When the technology delivers basic needs the technology is good enough and therefore "disappears" because of its irrelevance and the user experience has an important role and can begin to dominate the scene (see figure 6.1).
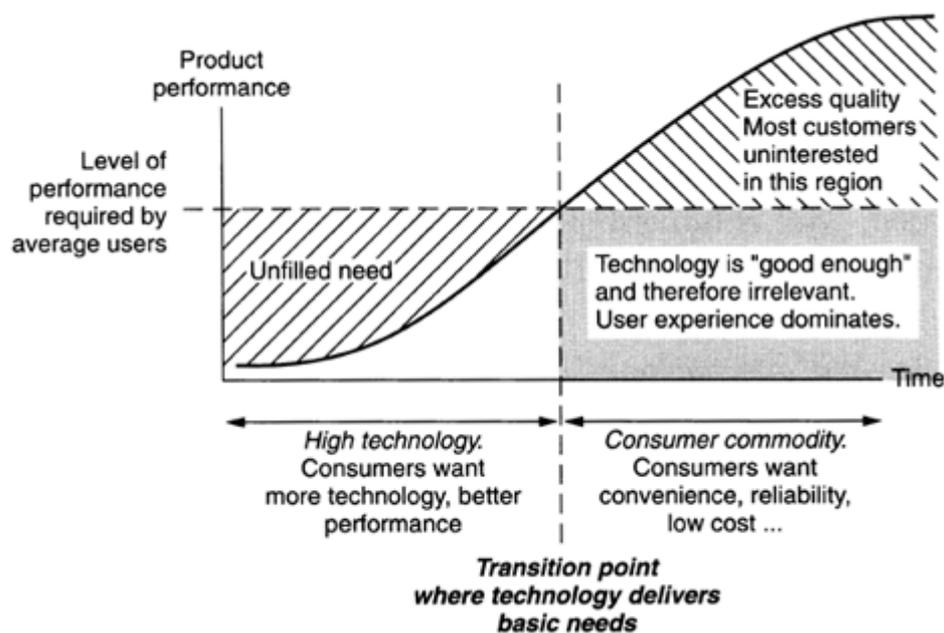

Figure 6.1. Transition point where technology delivers basic needs (Norman 1998, p. 31).

7 DISCUSSION

This concluding chapter of our master thesis will further discuss the topics we have presented so far and present our thoughts and ideas in a more continuous approach. We will discuss around the user related factors to consider when developing services for mobile use. This chapter also presents our final conclusion and our ideas about future work.

7.1 Adopting Mobile Internet

One question in our survey was about which aspects people think would increase Mobile Internet usage. In the results of this question we can make out that lower costs, better connection speed, better input and navigation possibilities together with larger screens and devices that are easier to use, are the main aspects that will make people use Mobile Internet more. Among these alternatives there are two that are distinguished, namely better connection speed and lower costs. This result, which highlights better connection speed and lower costs as most important aspects, supports the idea of that the technology around Mobile Internet not yet being mature. This is also supported by our survey results which show that the people that use Mobile Internet services today are mainly innovators and early adopters (group A).

Norman states that the majority of users of a technology are not the early adopters, they are among the early and late majority (Norman 1998 p. 32). If the majority of the users are going to adopt the new technology they have to be "won over". But how is that done? Norman's point is that when the user base changes the entire product must be changed. If the user related factors (mobile use, utility, user experience, social factors, needs and desires) we have presented will be taken under consideration during the development of Mobile Internet it is one step closer to a product more likely to be adopted by the majority of prospective users.

There are examples of popular applications that have helped technologies to be widespread at a fast rate. It is not uncommon for a technology or service to reach a threshold and then take off and rapidly spread among large groups of users. Naturally, it is very hard to forecast which will be the killer application for Mobile Internet. It is relatively usual that a killer application cannot be foreseen, but actually arises by chance. An example of this is the glue used for Post-it, which was originally developed for a completely different purpose (3M 1998). It may also be the case for Mobile Internet, that it will be a combination of several and not a single application that finally drives adoption. Different people will perceive different killer applications, depending on their specific needs and desires. However, looking at mobile communications and Internet, a strong candidate might be messaging of some sort. E-mail and SMS have grown to be some of the most popular services of Internet and mobile communications.

7.2 Valuing services

The benefits of Mobile Internet as it is presented today are not obvious to the general users. Hence, it is not easy for a user to make the connection between any need felt and what Mobile Internet services can offer. The benefits of Mobile Internet are very important to emphasise. All people face daily problems, tiny irritating activities that just have to get done. These are the kind of needs that Mobile Internet hopes to solve, but how this can be done is far from clear to most

people. Developers of Mobile Internet services must help users understand how Mobile Internet can help them. However, needs in terms of communication and socialisation may be more obvious as the use of mobile phones and e-mail already is familiar.

When valuing services and comparing the benefits with the negative aspects of using a new technology one has to consider the costs associated with the services. Costs are according to our survey a very important aspect that can not be neglected to increase Mobile Internet usage. In our survey we asked what the best description of Mobile Internet today was. The alternative with most answers was "something in a mobile that costs money" (see appendix B, p. 12). This clearly shows that users' apprehensions of Mobile Internet are directly related to high costs. During our interviews opinions concerning ways of taking charge and the actual costs were also frequently commented. Interesting to notice is that most interviewed users associate all Mobile Internet services with high costs. Today, it is actually possible to use a mobile device with GPRS and an instant messaging client and send text messages to people cheaper than by sending messages by SMS.

Costs are also an important aspect to the quality of use; it can be seen as an aspect of the user experience value. In the survey we can also see plain tendencies that costs are important for how a product is experienced. After the interviews we came to the conclusion that the way the user is being charged can not be overlooked. In the Internet world, the user is accustomed to some sort of flat-rate. In some sense of the word, using the Internet is thereafter free. The advantage to the customer is that it is easy to understand and that costs can be controlled in an easy way. In addition, the services offered on the Internet are mostly free of charge and many people may compare the Mobile Internet usage to regular Internet. This led many of the respondents to, in contrast to when comparing with the mobile phone, stress the fact that many people might not find it worth paying for something that is for free on the Internet.

To what degree the user perceives the usefulness and satisfaction of the service is important as it affects the service's added value. The user will expect an added value that is equivalent to the price they pay for the service. The Mobile Internet industry should not underestimate the users' reaction to the pricing strategies of Mobile Internet.

7.3   Making it easier

It is of significant importance that Mobile Internet is made accessible to users in an easy way. Norman (1998 p. 195f) argues that a technology needs to be easy to use to mature and thereby be adopted by the majority of users. The mobile portal can help users and will be a crucial part also for Mobile Internet. However, we are of the opinion that portals should serve a different purpose. Personalisation will be a much more important ingredient for the mobile portal. Too quickly get a hold of exactly the information you need is crucial to Mobile Internet. Hence, personalising the interface to enable the user to quickly find what she regularly needs will be a key. The portal should however not serve the purpose of concentrating the vast amount of information on the Internet to one personal comprehensive point. For each additional service in the portal, the interface will get more complex. Instead, the mobile portal should serve the role of finding the killer applications for each user of Mobile Internet and users will pick the services that are interesting to them personally.

A good concrete example of how to make Mobile Internet easier to use, is the Vodafone live! service. Vodafone live! which is sold as a package, a preconfigured mobile phone adjusted for Vodafone live! together with a Vodafone live! subscription, enable users to start using Mobile Internet services instantly without any hassle. This is a good example of how the technology, such as Internet settings and WAP addresses, are hidden from the user.

7.4 Conclusions

Our conclusions are not built on any single statement made during the interviews or in the survey, but instead built on accumulated understanding from the entire study. We have tried to highlight the most important findings in this conclusion. Many of the conclusions of our study are not revolutionising findings or discoveries. We have however found many interesting aspects and findings that may help understanding the future use and development of Mobile Internet.

Some of the findings related to our defined research questions are as follows. In the first question we asked how today's users use, apprehend and experience Mobile Internet. Among those who used Mobile Internet today, the use of e-mail was the most prominent service shown in our survey, web browsing and news services was also used frequently. We found out that users apprehend Mobile Internet in very different ways; however most users apprehend Mobile Internet services as being expensive and not very useful. The users' experience related to Mobile Internet use is dominated by the dissatisfaction regarding the lack of web based services adapted to small interfaces. Other relevant experiences are that Mobile Internet is slow and that most services still are expensive. When it comes to the second question, differences between Internet and Mobile Internet, most novel users argue that Internet and Mobile Internet are two different things while more experienced users see Mobile Internet and Internet basically as a whole. They consider Mobile Internet and Internet as the same net but by accessing it with different types of clients it can be experienced in different ways. In the third question, which was about when and why people want to use Mobile Internet services, users claimed that they mainly would use Mobile Internet services to make the everyday life easier by being able to access different information services. They would also like to be able to use all means of communication when being mobile. Users would use these services whenever being mobile, which can be seen as when being away from home and your stationary computer. Finally we asked our self the last question; what adds value to end-users of Mobile Internet services? The answer to this question is the most difficult to answer. We have discovered that users' needs are individual and that values of a service differ a lot. Though we have seen the need of hedonic surfing (e.g. time killing) is not as evident as the need for different utilitarian services. Basic values are those that make everyday life easier and these services shall have an obvious purpose.

To present our research results in a more concrete way we here present the some key findings from our study:

1. Users perceive Mobile Internet in very different ways (p. 20).
2. Mobile Internet is not yet mature since technology still dominates (p. 24, 28).
3. Mobile use is not necessarily about using services while moving, instead it can be viewed as when not having access to the resources you normally use, such as an Internet connected stationary computer (p. 19).
4. Mobile Internet can be seen as a part of the personal/local infrastructure of an individual (p. 20).

5. Users (preferably within group A, users interested in new technologies) want more web based services adapted for handheld devices such as PDA or communicators (e.g. Sony Ericsson P800) (p. 26).
6. Enabling communication is essential for users that are mobile (p. 27).
7. Users want full access to the Internet, not a limited version of it (p. 21).

During this thesis research we have found that the area of Mobile Internet related to users and user experience is very complex. There are numerous factors to consider when designing and developing services for mobile use and one of the most important factors is to know who you actually are designing for. When performing such a wide-ranging study as we have done, it is thus hard to give detailed recommendations. On the basis of our research results we though advise developers of Mobile Internet service to regard the following general recommendations when developing services for mobile use.

- **Focus on user needs and desires**. High-tech industries should to the greatest possible extent work towards a user focus. Consider the social factors, use in a mobile setting, the utility and the user experience when developing services for mobile use.
- **Hide the technology**. When developing and marketing Mobile Internet, it is important that the technology is hidden from the user. Users should regard the product, i.e. the usage of the tool as the innovation and not the technology behind the tool.
- **Be aware of that technology is not always wanted**. Despite the new services that enhanced technology enable, people may want to perform certain tasks in a traditional way and do not want technology to substitute or change it.
- **Do not try to capture the user**. Do not try to confine the user into a sub-Internet. Users want full access to the entire Internet.

To finally conclude our master thesis we present what we found as important aspects of what will make users adopt Mobile Internet. We have earlier argued that Mobile Internet has to mature further before being adopted by the majority of users. If the user related factors we have presented (mobile use, utility, user experience, social factors, needs and desires) will be taken under consideration during the maturity process of Mobile Internet it is one step closer to a technology more likely to be adopted by the majority of prospective users (i.e. users in group B). One way to accomplish this maturity at a faster rate is to make use of the already established ways of using technology. Browsing the Internet and use e-mail and instant messaging are becoming a more natural part in users' everyday lives. If making ordinary Internet truly mobile by enabling web browsing, e-mail, instant messaging and other Internet related services on a mobile device, the barrier for adopting Mobile Internet will be negligible and mass market will more easily adopt the innovation of Mobile Internet. When subsequently enhancing the Mobile Internet and taking advantage of the mobile qualities such as positioning and context related services Mobile Internet may one day become what mobile communications and Internet are today.

7.5   Future work

During our work with this thesis we have come across several different areas that could be of interest to investigate further to get a better understanding of mobile use and how Mobile Internet services can evolve and affect our daily lives and behaviours. These are:

- Perform further work on each topic that is included in the term quality of use (utility, user experience, social factors, needs and desires) and also more thorough investigate their relation to each other.
- Make deeper studies in the use of personal infrastructure and its relation to mobility. How can Mobile Internet really help in everyday life situations?
- Investigate how multimodality (i.e. visual, auditive, and tactile interaction) can improve the use of mobile technologies and services.
- Perform field studies of how users in determined groups, such as families or other social groups can use Mobile Internet as means for communicating and socialising.
- How to design graphical user interfaces for small interfaces. Investigate the use of metaphors and other methods when designing user interfaces for small displays.

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